Headquarters U.S. Air Force

Integrity - Service - Excellence

Driving Innovation In the U.S. Air Force

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Briefing to
Aeronautics & Space Engineering Board

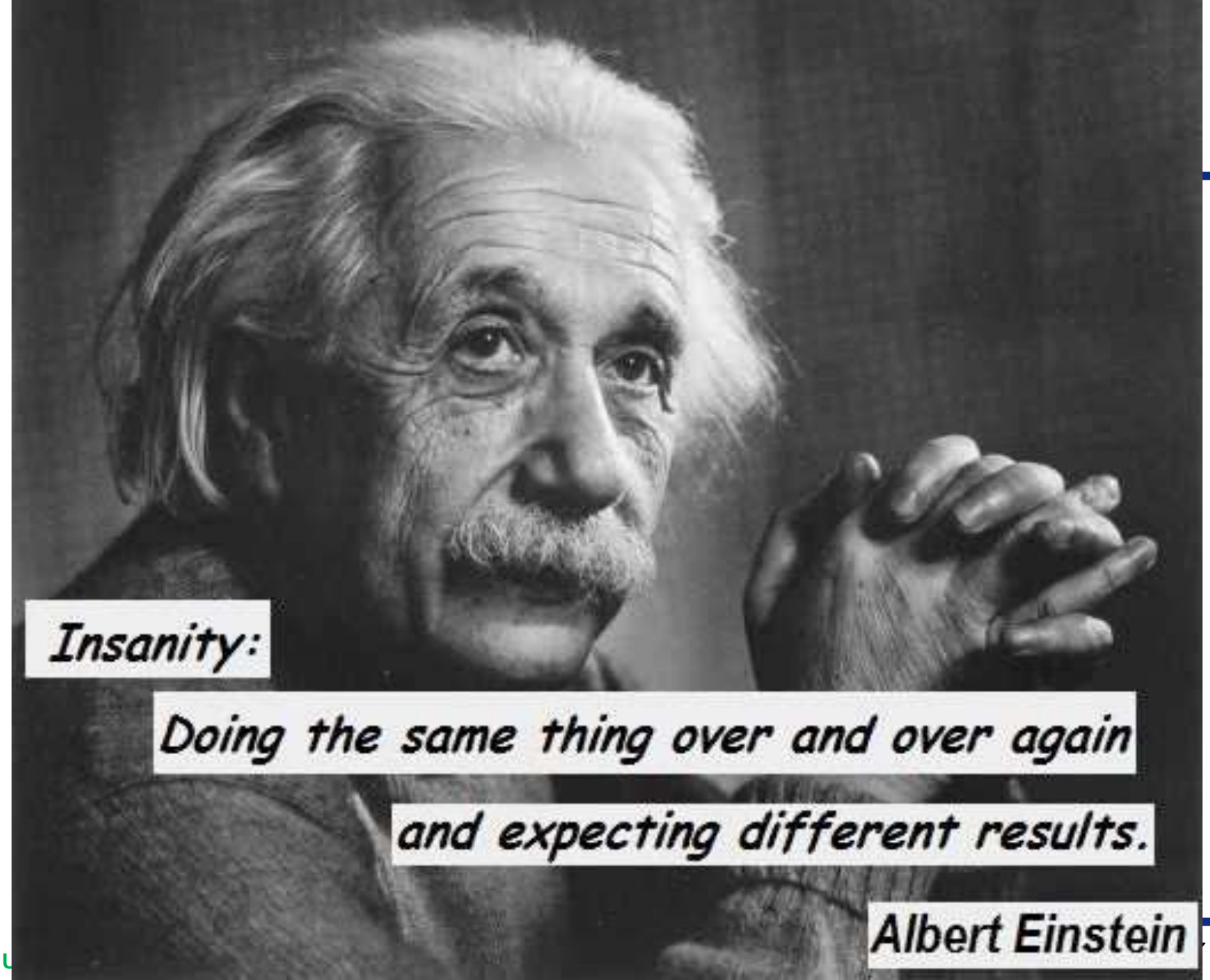
11 Oct 2017

Findings of the Defense Innovation Board (1/2)

- DoD is unprepared to meet new threats
- DoD is not technologically, organizationally, procedurally, or culturally equipped to outpace our adversaries in the years ahead
- How we got here:
  - DoD no longer dominates technological innovation—the private sector does, and little-known companies are producing the most leading-edge solutions in software development, artificial intelligence, and machine learning
  - DoD processes are not fast or agile enough to put technological solutions in warfighters' hands and meet immediate threats
  - DoD's leadership and grassroots understand the need for change, but the "frozen middle" kills new ideas because it doesn't know how to incorporate them
  - DoD's command structure rewards conformity and avoiding risk—the very concept that undermines the entrepreneurial spirit needed to keep pace with new threats

Defense Innovation Board Findings (2/2)

- Defense Innovation Board found that:
  - Many in DoD want to change, but don't know how to break out of a multi-billion dollar system and infrastructure that is resistant to modification
  - Those who resist change are not unreasonable people, but believe change is too risky to undertake, with uncertain consequences
  - It is far riskier to do nothing or adopt change at the margins because that is a recipe for long-term strategic and technological inadequacy against adversaries that are more agile and free of cumbersome processes
  - Without an exponential (i.e. algorithm-driven) uptick in the speed at which we engage our adversaries, we will be at a significant disadvantage


Insanity:
Doing the same thing over and over again
and expecting different results.
Albert Einstein

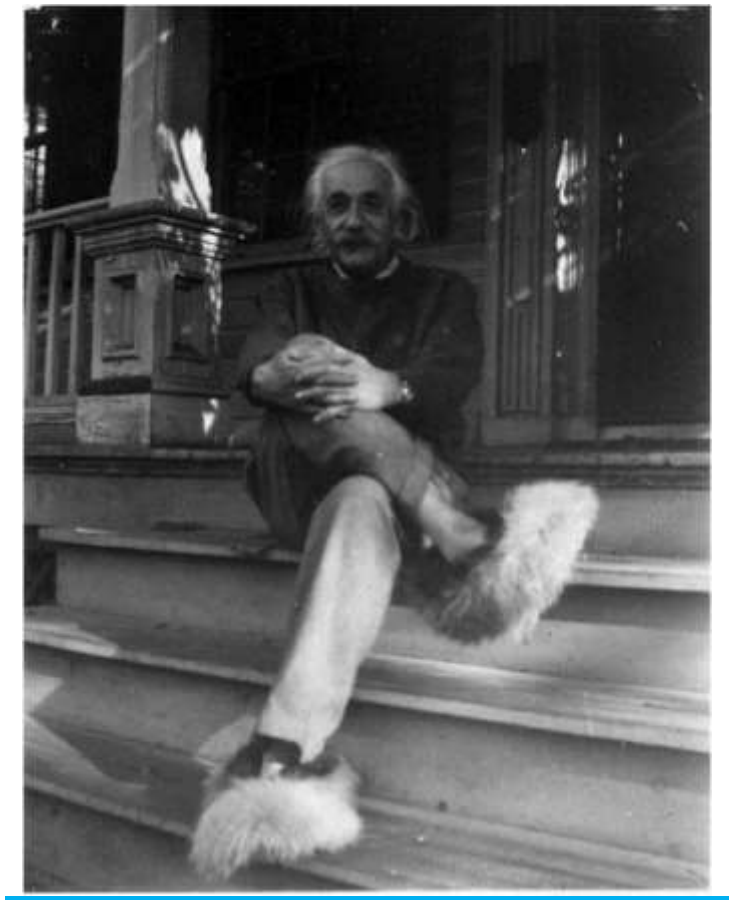
Need for Change is Recognized

- **Office of Transformational Innovation created to identify, demonstrate and execute changes within Air Force acquisition *processes* to deliver better capability, faster and cheaper**
  - **Bending the Cost Curve (BTCC) Initiative to address the unsustainable escalation in weapon system costs and development times through dialogue with industry, innovative acquisition strategies, and actions**
  - **OTA v. FAR**
  - **Acquisition Wargames for Procurement Strategies**

Crawl

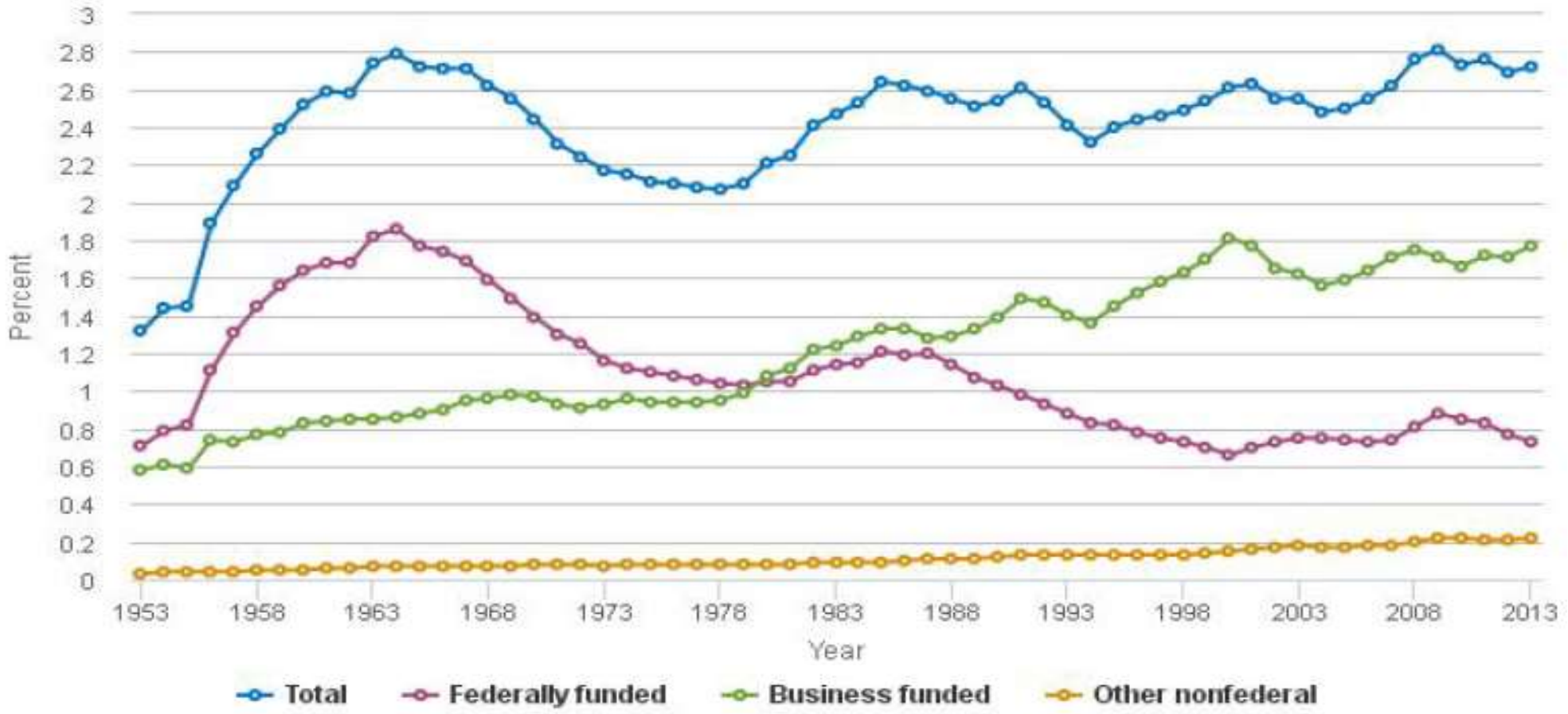
Walk

Teleport



"It is not that I'm so smart. But I stay with the questions much longer."

R&D Funding Trend



Ratio of U.S. R&D to Gross Domestic Product – 1953-2013

Source: National Science Foundation, National Center for Science and Engineering Statistics, National Patterns of R&D Resources (annual series)

Top 20 Industry R&D Spenders

2016 Global Innovation 1000 Study – Strategy + Business Magazine

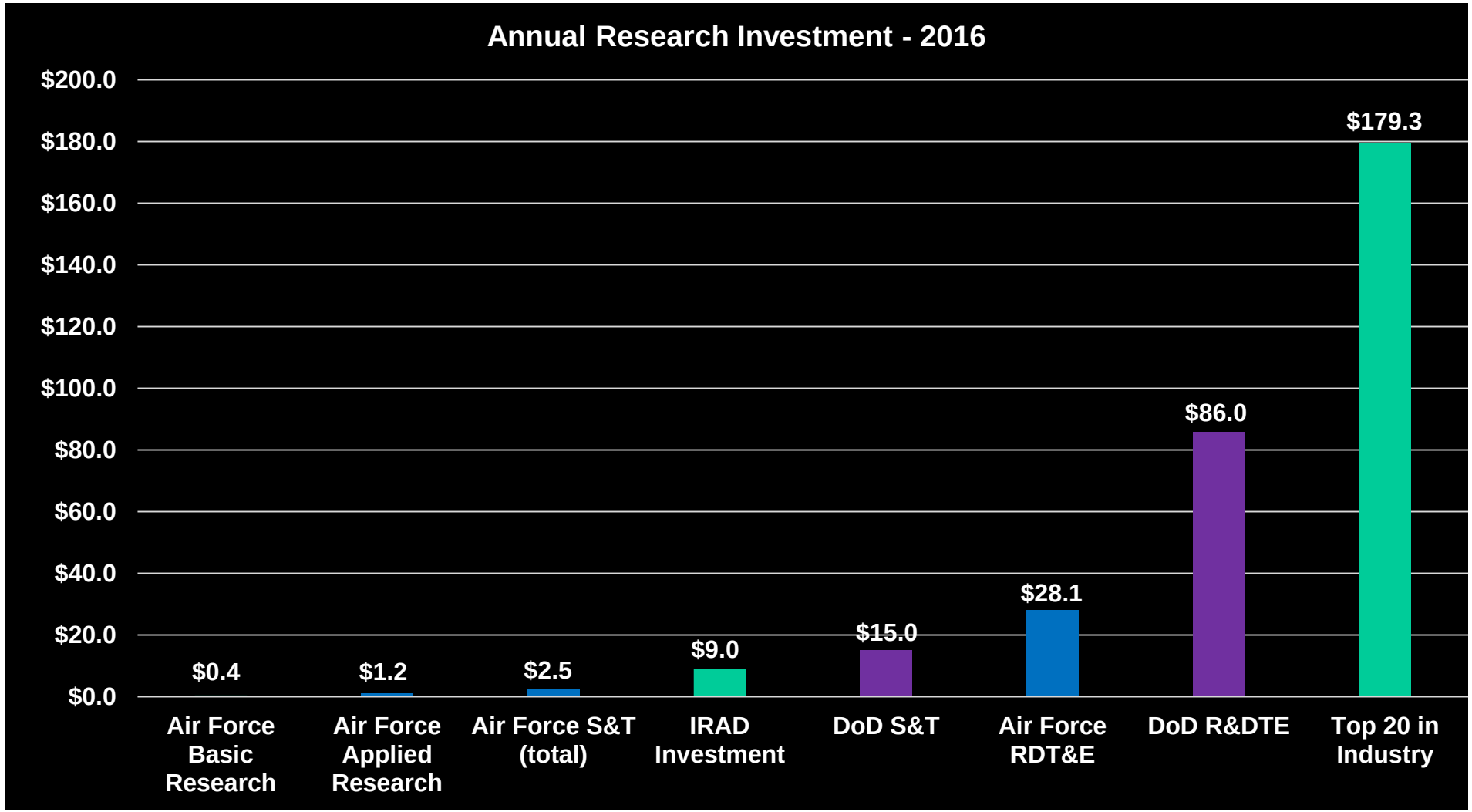
2016 Rank	Company	R&D Spend ($Bn)*
1	Volkswagen	13.2
2	Samsung	12.7
3	Amazon	12.5
4	Alphabet	12.3
5	Intel Co	12.1
6	Microsoft	12
7	Roche	10
8	Novartis	9.5
9	Johnson & Johnson	9
10	Toyota	8.8
11	Apple	8.1
12	Pfizer	7.7
13	General Motors	7.5
14	Merck	6.7
15	Ford	6.7
16	Daimler	6.6
17	Cisco	6.2
18	AstraZeneca	6
19	Bristol-Myers Squibb	5.9
20	Oracle	5.8

* R&D spend datecent full-year figures reported prior to July 1st.

Combined just the first seven companies spend more on R&D than DoD

$84.8B

Comparison of R&D Investments



AFRL S&T Business Model

Inputs

Air Force*
$2,587M

External
$2,289M

AFRL Workforce

$4.876B Total Funds FY17

Investments

$225 M
Academia

$802 M
Small Business

$3,245 M
Industry

$604M
In-House

$96 M**
International Collaboration

Products

Basic Research

Intellectual Property

Technology Base

Advanced Demonstrations

Fielded Capabilities

*Includes SDPE
** In kind support

AFRL: Turning Science into Capability

READY RESPONSIVE RELEVANT REVOLUTIONARY

Now Near Mid Far

15-20%
($375-$500M/yr)

1-2%
($25-$50M/yr)

40-45%
($1,000-$1,125M/yr)

35-40%
($875-$1,000M/yr)

MISSION

Leading the discovery, development, and integration of affordable warfighting technologies for our air, space, and cyberspace force.

Game Changers

Hypersonics
- Survivable, fast-flying
- Defeat deep-layered A2/AD strategies

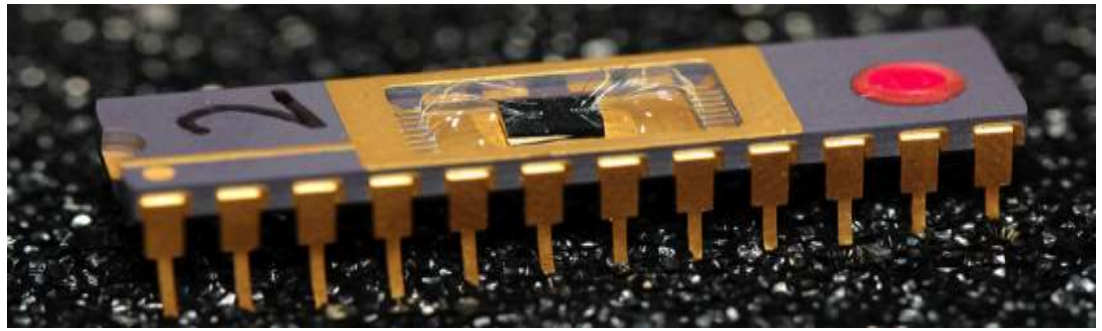
Directed Energy
- High Power Microwave alternative to kinetic weapons
- Lasers with air & ground selectable effects & reduced collateral damage

Autonomy
- Decisions at speed of computing
- Self-awareness & troubleshooting intelligence

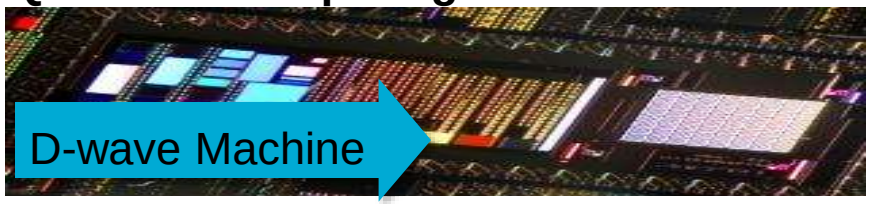
Quantum Computing, Synthetic Bio, Advanced Additive Manufacturing, Microelectronics, Optimized Human Performance, Neuromorphic Computing, Electronic Warfare, Alternative Navigation, Nano-energetics, Space Based Ops…Others

Other Game Changing Technologies

Neuromorphic Computing



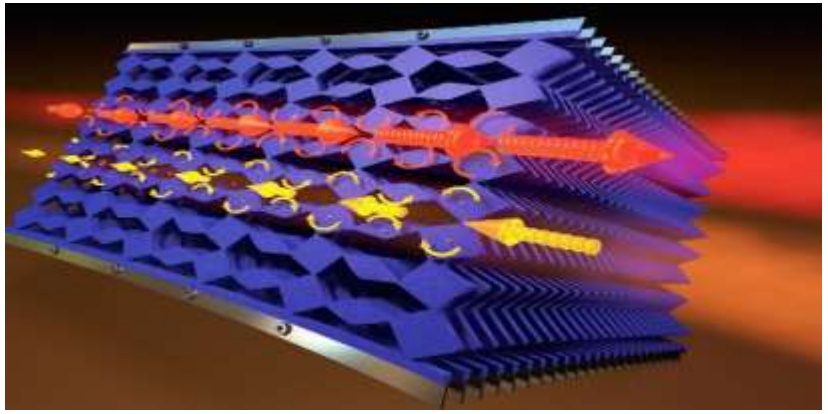
Quantum Computing



Machine Learning

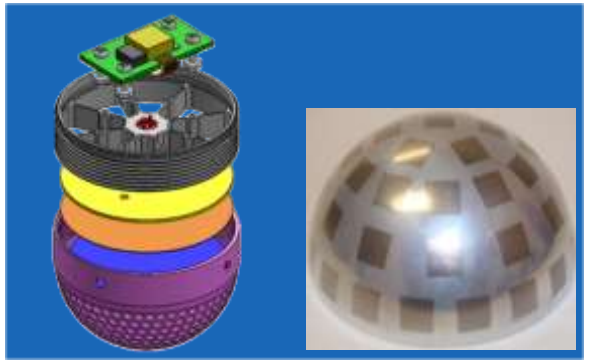
Bio and Life Sciences

Metamaterials

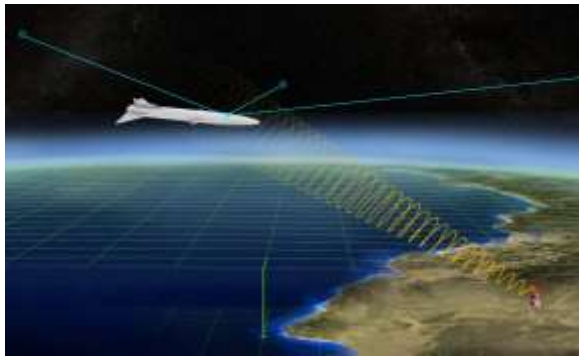


Enabling Future Capabilities

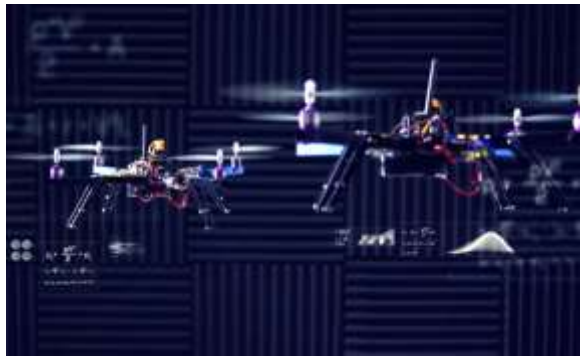
Additive Manufacturing



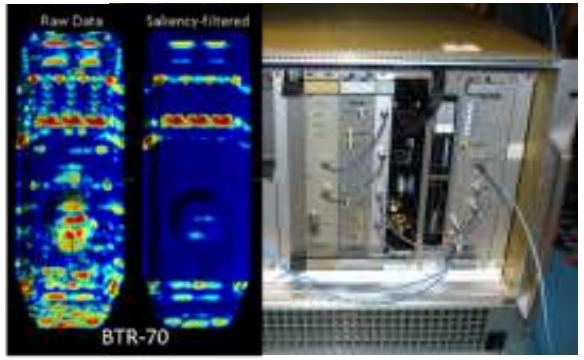
Alternative Navigation



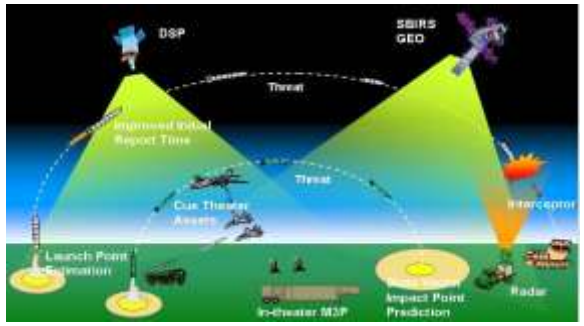
Networked Capabilities



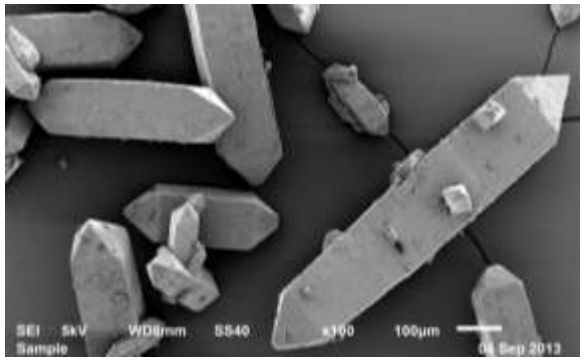
Electronic Warfare



Space

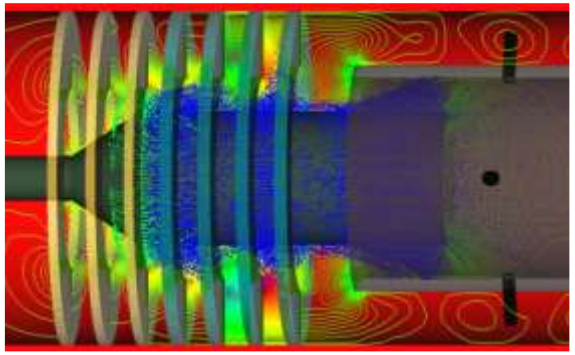


Nano-Energetics



Human Performance

Modeling & Simulation



Questions? Lunch?